

This Method of Operation was Prepared from Issue 12 of Drawing ES-240293.

METHOD OF OPERATION

Panel System - Starting Circuit - For Use With Panel Line Finder - With Trip Circuit Lockout Feature.

DEVELOPMENT

1. PURPOSE OF CIRCUIT

This circuit is used to control the routing of calls to the respective line finder selectors and to start an idle selector hunting over the line terminals for the calling line.

2. WORKING LIMITS

2.1 None.

OPERATION

3. PRINCIPAL FUNCTIONS

The principal functions of this circuit are:

- 3.1 To route the call.
- 3.2 To start a selector hunting for the calling line.
- 3.3 To release the trip relay in the associated trip circuit, thus permitting another call to start in any other group.
- 3.4 To prevent a second call being served in any trip circuit until all calls waiting in other trip circuits have been served.
- 3.5 Each regular start circuit is equipped with an emergency plug and jack for immediately replacing the regular circuit with an emergency circuit at any time.
- 3.6 To test the line finders.
- 3.7 To return to normal.
- 3.8 To free the start circuit.

4. CONNECTING CIRCUITS

This will function:



- 4.1 With trip circuit arranged with lockout feature.
- 4.2 With any standard line finder and district circuit.

#### DESCRIPTION OF OPERATION

##### 5. ORIGINATING CALL

When the receiver at the calling station is removed from the switch-hook, various relays in the line and trip circuits operate operating the STA relay from ground over lead I break contacts of the CA and SB relays to battery through the E resistance in parallel with the winding of the STA relay and operating the AL relay over lead AL. The STA relay operated short circuits the 500 ohm winding of the CA relay preventing it from operating and starting a line finder in sub-group B while a call is going through, connects ground to lead K and closes a circuit over lead ST thereby starting a line finder hunting for the calling line. Ground on lead K operates the K and LO relays in the trip circuit, releasing the AL relay if it is not held operated through other trip circuits. The AL relay operated holds any LO relays locked up that may be operated in any trip circuits thereby preventing a second call from starting in any trip circuit until all calls waiting in other trip circuits have been served.

##### 6. STARTING LINE FINDER

As the line finder starts upward, a circuit is closed over lead Y operating the GA relay. The GA relay operated removes ground from lead ST, locks to ground on the armature of the STA relay and closes a circuit operating the STP-A magnet. The STP-A magnet remains operated until the release of the STA relay. Ground is also connected to lead CH operating the CA or CB relay when all line finder selectors in a group are off normal. As the line finder continues upward, ground is momentarily connected to lead K, thus releasing the TR relay in the trip circuit but holding the STA relay operated. When ground is disconnected from lead K the STA relay releases and (a) opens the lock circuit through the GA relay which releases (b) opens the circuit lead X, thereby opening the locking path of the line finder make relay, (c) opens the circuit through the STP-A magnet which releases and steps the brushes of the A group distributor selector to the terminals (d) removes the short circuit from the 500 ohm winding the CA relay, but the CA relay will not operate unless all selectors in the group are busy.

The operation for a call originating in the last 20 lines of a group of 40 lines will be similar to that already described for the first 20 lines except that the STB, CB and GB relays instead of the STA, CA and GA relays.



7. EMERGENCY RELEASE OF START CIRCUIT

If either the STA or STB relay remains operated due to the failure of the TR or TR-1 relay in the trip circuit to be shunted out and released, the KF relay operates as soon as interrupter contacts 1, 3 and 5 close and locks under control of the STA or STB relay. If it remains locked for approximately two seconds, interrupter contacts 2 and 4 close and connect ground to either the TR or TR-1 relay in the trip circuit, depending on whether the call is through the A or B sub-group, releasing the TR or TR-1 relay. When ground is removed by the opening of the interrupter contacts 2 or 4 the STA or STB relay releases releasing the KF relay and restoring the circuit to normal.

8. START CIRCUIT ALARM

The closure of the interrupter contact 6 which occurs at the same time contacts 2 and 4 are closed while the KF relay is operated, operates the KA relay. The KA relay operated locks under control of the key at the trouble desk, lights a lamp at the trouble desk individual to the line finder frame and operates an alarm. The operation of the key releases the KA relay, extinguishing the lamp and silencing the alarm.

9. ALL SELECTORS IN ONE SUB-GROUP BUSY

If all the selectors in sub-group A, for example, are busy, the CA relay operates in a circuit from ground over lead CH, 500 ohm winding of the CA relay to battery through the 600 ohm resistance C. The CA relay operated transfers the circuit over lead I from the winding of the STA relay to battery through the winding of the SA relay and the break contact of the SB relay. When a call is now received the SA relay operates in turn operating the STB relay. The STB relay operated operates a relay in the district, thus starting a selector in the B sub-group hunting for the calling line, and closes a locking circuit through the 1000 ohm winding and make contact of the CA relay. This is to prevent the release of the CA relay should a selector become available in the A sub-group while a call is going through the B sub-group. If all selectors in sub-group B are busy the operation is similar except that the CB, SB and STA relays now operate. The STA relay operated, starts a selector in the A sub-group hunting as explained before.

10. ALL SELECTORS IN BOTH SUB-GROUPS BUSY

If all the selectors in both sub-groups are busy, both the CA and CB relays are operated. Should a call be received in either sub-group under these conditions the corresponding SA or SB relay operates but neither the (STB) nor (STA) relay operates as the circuits to



ground on the armatures of the CA and CB relays are open. When a call is received in the A or B sub-group while all selectors are busy, the message register in the start circuit operates through the make contacts of the SA relay to ground on the armature of the CB relay if the call is in sub-group A or through the make contacts of SB relay to ground on the armature of the CA relay if the call is in sub-group B. The message register thus indicates the number of calls which were originated while all the line finders were busy.

#### 11. TESTING LINE FINDER SELECTOR

The testing equipment which is shown associated with the start circuit provides for the testing of any particular line finder selector at any time. The test line used with the test box circuit for making the test is the first or bottom line of the bottom bank in both the A and B sub-groups, the first line terminals in both sub-groups being connected together. When the #184 plug shown on the line finder circuit is inserted in the test jack of the line finder under test, the ST and ST-1 leads are connected together, and the circuit which supplied the battery to the ST lead through the LF relay in the line finder circuit is transferred to lead Z, or if the automatic test circuit is used, the winding of the LF relay in the line finder circuit is connected through the test circuit to the start circuit over lead Z. When the plug of the test box cord is inserted in the test jack or the line finder is being tested by the automatic test circuit, the A relay operates from ground on the test jack or lead to automatic test circuit to battery on the contact of the AL relay, provided the AL relay is normal, indicating that there are no calls waiting to be served; and also in the case of the automatic test circuit, provided the line finder is idle. The A relay operating locks to battery on its contact, opens the circuit over the TR lead, thereby preventing any other calls from starting, opens the battery supply lead to the AL relay thereby preventing this relay from operating on calls waiting to be served, and connects ground to the winding of the B relay which operates if both STA and STB relays are normal, indicating that the start circuit is ready to handle the test call. The B relay operating locks under control of the A relay, closes the test line through, thereby operating the L relay in the test line, opens the series path for locking up TR relays in all trip circuits beyond the first, in series with the STA relay, thereby preventing a call from being started in a succeeding trip circuit after the start circuit is free and before the test circuit has had time to start the line finder under test, operates the C and C-1 relays and connects battery to the winding of the D relay.

If the automatic test circuit has found the line finder busy the circuit through the A relay is left open, the A relay does not operate, and the test call is blocked until the line finder becomes idle. The C relay operated (a) opens the circuit through the SA relay preventing



this relay from operating and starting a line finder in the B group in case all the line finders in the A group become busy while the test call is going through (b) opens the normal ST lead, (c) connects lead Z through to the STA relay in the start circuit and (d) opens the circuit through the STB relay. The C-1 relay operated (a) closes the circuit over the TR lead from battery on the normally closed contacts of the STA and STB relays, (b) connects the K lead of sub-group A with the K lead of sub-group B thereby connecting the K commutator segments of all the selectors of both sub-groups together and (c) connects the Y lead of sub-group A with the Y lead of sub-group B so that the GA relay will be operated by a selector in either sub-group. When the L relay in the test line operates, the trip circuit functions and connects ground through the TR relay in the trip circuit over lead TR, make contact of C-1 relay, break contacts of STA and STB relays to battery, operating the TR relay in the trip circuit. The above TR relay locks over lead I, break contacts of CA and SB relays to battery through the winding of the STA relay in parallel with the 1000 ohm resistance, operating the STA relay. The STA relay operated short-circuits the 500 ohm winding of the CA relay, connects ground to lead K, operates the D relay, and closes a circuit from ground through the break contacts of the GA relay, make contacts of the C relay over lead Z to battery through the LF relay in the line finder circuit, causing the line finder to start hunting for the calling line. The D relay operated locks to ground on the armature of the A relay. When the STA relay releases after the line finder has passed the tripping zone, the E relay operates from ground on the left inner armature of the STA relay, make contacts of the D relay to battery through the break contact and winding of the E relay. The E relay operated locks to ground on the armature of the A relay, releases the C and C-1 relays, closes the series path for locking up the TR relays in the trip circuits beyond the first, which was opened by the B relay, closes the circuit from battery on the contacts of the STA and STB relays which was opened by the operation of the A relay and later closed by the operation of the C-1 relay through to the TR lead, and closes battery to the AL relay which was removed by the operation of the A relay. This leaves the start circuit prepared to handle regular calls.

When the plug of the test box cord is removed from the jack, or the automatic test circuit has been restored to normal, the A relay is released, releasing the B, D and E relays and restoring the testing equipment to normal.

## 12. SUB-GROUP "A" LINE FINDERS ONLY EQUIPPED

When only sub-group "A" line finders are equipped, "C" wiring is omitted and D wiring furnished, and the operation of relay (SA) when a call comes in with all "A" line finders busy and relay (CA) operated, operates the message register. Also relay (STB) is prevented from operating under this condition by the omission of "C" wiring.

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13. SUB-GROUP "B" LINE FINDERS ONLY EQUIPPED

When only sub-group "B" line finders are equipped, "L" wiring is omitted and "N" wiring furnished, and the operation of relay (SB) when a call comes in with all "B" line finders busy and relay (CB) operated, operates the message register. Also relay (STA) is prevented from operating under this condition by the omission of "L" wiring.

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